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Potential of CLSM in studying some modern and fossil palynological objects

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Abstract

© 2017 Royal Microscopical Society. We have tested possibilities and limitations of confocal laser scanning microscopy to study the morphology of pollen and spores and inner structure of sporoderms. As test objects, we used pollen grains of the modern angiosperm Ribes niveum (Grossulariaceae) and Datura metel (Solanaceae), fossil angiosperm pollen grains of Pseudointegricorpus clarireticulatum and Wodehouseia spinata dated to the Late Cretaceous, fossil gymnosperm pollen grains of Cycadopites-type dated to the Middle Jurassic, and fossil megaspores Maexisporites rugulaeferus, M. grosstriletus, and Trileites sp. dated to the Early Triassic. For comparative purpose, we studied the same objects with application of conventional light, scanning electron (to entire pollen grains and spores or to semithin sections of their walls), or transmission electron microscopy. The resolution of confocal microscope is much lower than that of electron microscopes, as are its abilities to reconstruct the surface patterns and inner structure. On the other hand, it can provide information that is unreachable by other microscopical methods. Thus, the structure of endoapertures in angiosperm pollen grains can be directly observed. It is also helpful in studies of asymmetrical pollen and pollen grains bearing various appendages and having complicated exine structure, because rotation of 3-D reconstructions allows one to examine all sides and structures of the pollen grain. The exact location of all visible and concealed structures in the sporoderm can be detected; this information helps to describe the morphology and inner structure of pollen grains and to choose necessary directions of further ultrathin sectioning for a transmission electron microscopical study. In studies of fossil pollen grains that are preserved in clumps and stuck to cuticles, confocal microscope is useful in determining the number of apertures in individual pollen grains. This can be done by means of virtual sections through 3-D reconstructions of pollen grains. Fossil megaspores are too large and too thick-walled objects for a confocal study; however, confocal microscope was able to reveal a degree of compression of fossil megaspores, the presence of a cavity between the outer and inner sporoderm layers, and to get some information about sporoderm inner structure.

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Keywords

Confocal laser scanning microscopy (CLSM), Light microscopy (LM), Megaspores, Pollen grains, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM)